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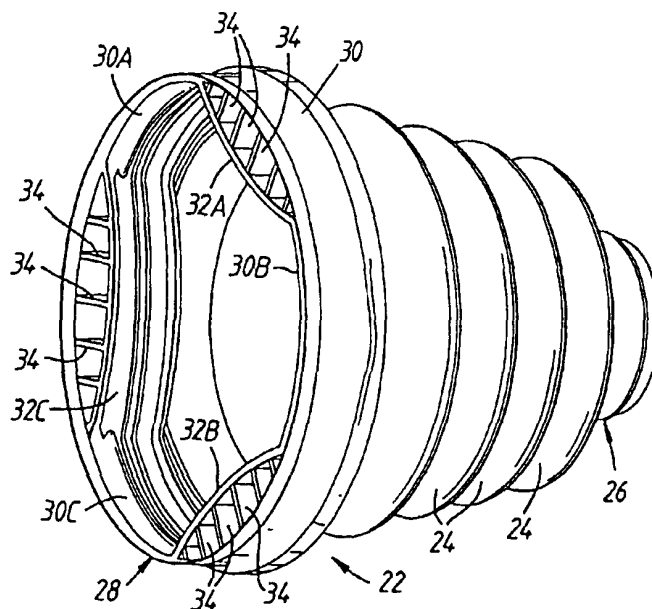
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(54) **Protective bellows**

(57) A protective bellows has a large-diameter end with a fixing collar (28) for sealingly embracing the external tri-lobed surface of the housing of an articulation joint for a motor vehicle transmission. The fixing collar (28) comprises a cylindrical surface (30) made up of surface portions (30A, 30B, 30C) for engaging the three lobes of the housing, and three equi-angularly spaced

inwardly curved integral wall portions (32A, 32B, 32C) which are shaped to engage the spaces or grooves between the three lobes on the housing. Each of these wall portions (32A, 32B, 32C) is spaced from the cylindrical surface (32) and supported by a plurality of flexible and resilient ribs (34). The arrangement is such that the gripping force of the fixing collar (28) on the tri-lobed housing is substantially constant around its periphery.



**Fig. 2**

## Description

[0001] The invention relates to a protective bellows having a fixing collar for attaching the bellows to and around an outside peripheral non-circular surface of a housing, the fixing collar comprising resilient material defining at least one curved part of a peripheral inside surface and at least one flexible wall portion mounted on the resilient material and directed peripherally inwardly therefrom to define a surface portion matching and for engaging part of the outside surface of the housing. The invention also relates to a protective bellows for attachment to an externally tri-lobed housing of an articulation joint for the transmission of a motor vehicle, in which the bellows has an integral fixing collar which is made of resilient material defining three mutually separated part-cylindrical surfaces lying in a common cylindrical plane and matching the external surfaces of the lobes of the housing, the part-cylindrical surfaces being interconnected by three angularly spaced inwardly directed projecting surfaces shaped so as to match the external surface portions on the housing between the lobes thereof.

[0002] Such a bellows is shown in GB-A-2 042102. In this bellows, the fixing collar has a peripherally extending circular wall from spaced-apart inward portions of which extend solidly moulded portions which match parts of the outside surface of a universal joint housing between lobes thereof. Such solidly moulded portions are relatively massive, may not be easy to produce, and may cause variation of the gripping force of the collar around the circumference thereof. The invention is concerned with this problem.

[0003] According to the invention, the bellows as first set forth above is characterised in that the flexible wall portion is resiliently supported by a plurality of peripherally spaced support means arranged externally of the flexible wall portion.

[0004] Also according to the invention, the bellows as secondly set forth above is characterised in that each projecting surface is formed by a wall portion integral with the part-cylindrical surfaces, and a plurality of peripherally spaced supports connected to and mounted on the outside of the projecting surfaces for resiliently supporting them, whereby the material of the fixing collar sealingly grips the outside surface of the housing with a substantially constant force around its periphery.

[0005] Protective bellows embodying the invention will now be described, by way of example only, with reference to the accompanying diagrammatic drawings in which:

Figure 1 is a perspective view of part of a transmission joint of a vehicle;

Figure 2 is a perspective view of one of the protective bellows, for fitting onto the joint of Figure 1; and

Figure 3 corresponds to Figure 2 but shows a modified form of the bellows of that Figure.

[0006] Figure 1 shows part of an articulated joint for the transmission of a vehicle, particularly for front wheel drive transmission. The joint comprises a housing 5, preferably made of steel, of tri-lobed construction. Its external surface is provided with grooves 6, 7 and 8 between lobes 9, 10 and 11 with corresponding grooves 12, 14 and 16 on its internal surface. The lobes 9, 10 and 11 are formed by respective parts of the same cylindrical surface. The grooves 12, 14 and 16 locate the balls or rollers (not shown) of the joint which allow the necessary articulating movement between the two parts of the vehicle transmission which are to be interconnected by the joint. As shown, the housing 5 is connected to a splined shaft 18 forming one of the parts of the transmission. The other part (not shown) comprises a shaft which is, in use, drivingly connected to the balls or rollers of the joint via the opening 20 of the housing 5.

[0007] In order to protect the mechanism of the joint from contamination and dust and to retain the necessary lubricant within the housing 5, a flexible bellows is attached to the housing 5 so as to close the opening 20.

[0008] One form of the protective bellows is shown at 22 in Figure 2. Preferably it is produced from thermoplastics material by blow-moulding. It comprises bellows turns 24 integrally extending with successively increasing diameters from a small diameter fixing collar 26 to a large diameter fixing collar 28. In use, the fixing collar 26 elastically and sealingly grips around the drive shaft (not shown) of the transmission which is connected to the balls or rollers within the housing 5 (Figure 1), and the large diameter collar 28 similarly grips the housing 5 in the manner to be explained.

[0009] The fixing collar 28 has an internal surface matched to shape the external surface of the housing 5. Thus, it comprises portions 30A, 30B and 30C which form part of the inner cylindrical surface of a rim 30 and which are interconnected by inwardly curved thin integral wall portions 32A, 32B and 32C. The interrupted cylindrical wall portions 30A, 30B and 30C are sized and shaped and mutually spaced to match the sizes, shapes and positions of the part-cylindrical surface portions 9, 10 and 11 of Figure 1. Similarly, the inwardly curved walls 32A, 32B and 32C of the fixing collar are sized, shaped and mutually spaced so as to present inwardly facing surfaces matching the surfaces of the grooves 6, 7 and 8 of the housing 5.

[0010] The inwardly curved walls 32A, 32B and 32C are supported from the inner cylindrical surface of the rim 30 by means of integral connecting ribs 34 which extend in radial or chordal directions.

[0011] In use, the bellows 22, with its small diameter collar 26 fitted over the drive shaft (not shown), is fitted onto the housing 5 (Figure 1) so that the large diameter collar 28 externally and sealingly grips the external surface of the housing, with the part cylindrical portions

30A,30B and 30C engaging the part-cylindrical surface portions 9,10 and 11 and with the inwardly curved walls 32A,32B and 32C engaging the grooves 6,7 and 8.

[0012] The fitting process may be completed by means of an encircling band which is tightened around the external surface of the rim 30.

[0013] The ribs 34 are shaped, positioned and spaced apart so that the gripping pressure applied by the fixing collar 28 to the external surface of the housing 5 is substantially constant around the whole circumference. Preferably, there are at least three ribs 34 for each inwardly curved wall portion 32A,32B,32C. The inwardly curved wall portions 32A,32B and 32C and the ribs 34 preferably have a thickness between a minimum value of about 1 mm and a maximum value of about 4 mm.

[0014] The form of the collar 28 is relatively simple to realise using blow-moulding (injection) techniques. In addition, the arrangement of the inwardly curved walls 32A,32B,32C with the supporting ribs 34 is advantageous as compared with arrangements which use solidly moulded similarly-shaped portions instead. The latter arrangements are relatively massive. Furthermore, they are difficult to produce by moulding: difficulties of removal from the mould occur. Furthermore, such arrangements cause there to be a significant variation in the gripping force applied around the circumference of the fixing collar.

[0015] In the modification shown in Figure 3, in which items corresponding to those in Figure 2 are similarly referenced, the continuous circular rim 30 of Figure 2 is not present in the regions of the inwardly curved integral wall portions 32A,32B and 32C. Instead, the ribs 34 in Figure 3 are extended to have outer extremities 34A lying in the same circumferential plane as the outer surfaces of the interrupted cylindrical wall portions 30A,30B and 30C. The ribs 34 are strengthened by circumferentially directed ribs 36 in order to ensure that the fixing collar 28 seals effectively to the external surface of the housing 5. As before, the ribs 34,36 can be arranged so that the gripping pressure applied by the fixing collar 28 to the external surface of the housing 5 is substantially constant around the whole circumference.

[0016] The arrangements described and illustrated are also advantageous in that they enable the bellows to be easily and simply fitted onto a tri-lobed housing such as shown in Figure 1. It is therefore not necessary for the housing to be formed so as to be tri-lobed on its inner surface but smoothly cylindrical on its outer surface; such an arrangement is relatively difficult to manufacture and produces a relatively heavy housing. The arrangements described and illustrated are also advantageous as compared with arrangements in which a housing of the form shown in Figure 1 is modified by the addition of an external annular rim on the housing for receiving a fixing collar of wholly cylindrical internal surface.

## Claims

1. A protective bellows having a fixing collar (28) for attaching the bellows to and around an outside peripheral non-circular surface of a housing (5), the fixing collar (28) comprising resilient material defining at least one curved part (30A,30B,30C) of a peripheral inside surface and at least one flexible wall portion (32A,32B,32C) mounted on the resilient material and directed peripherally inwardly therefrom to define a surface portion (32A,32B,32C) matching and for engaging part (6,7,8) of the outside surface of the housing (5), characterised in that the flexible wall portion (32A,32B,32C) is resiliently supported by a plurality of peripherally spaced support means (34) arranged externally of the flexible wall portion (32A,32B,32C).
2. A bellows according to claim 1, characterised in that there are a plurality of the flexible wall portions (32A, 32B,32C) respectively matching and engaging different parts (6,7,8) of the outside peripheral surface of the housing (5), each flexible wall portion (32A, 32B,32C) being resiliently supported by a respective plurality of the peripherally spaced support means (34), the flexible wall portions (32A,32B, 32C) alternating around the periphery of the fixing collar (28) with respective said curved parts (30A, 30B,30C) of the peripheral inside surface defined by the resilient material.
3. A bellows according to claim 1 or 2, characterised in that the or each said curved part (30A,30B,30C) of the peripheral inside surface of the fixing collar (28) matches and is for engaging the outside peripheral surface (9,10,11) of the housing (5) where this is not engaged by the or each flexible wall portion (32A,32B,32C).
4. A bellows according to claim 2, characterised in that the peripheral inside surface of the fixing collar (28) is of part-cylindrical shape and the flexible wall portions define three equi-angularly spaced inwardly projecting lobes (32A,32B,32C), the peripheral inside surface of the fixing collar (28) between each pair of adjacent lobes constituting a respective said curved part (30A,30B,30C) for engaging the outside peripheral surface (9,10,11) of the housing (5) where this is not engaged by each flexible wall portion (32A,32B,32C), whereby the fixing collar (28) is for attaching the bellows to the outside peripheral surface of the tri-lobed housing (5) of a transmission joint in a motor vehicle.
5. A bellows according to any preceding claim, characterised in that the resilient material defines the whole of the peripheral inside surface (Fig. 2) and in that the peripherally spaced support means (34)

extend from the outside surface of the or each flexible wall portion to the peripheral inside surface.

6. A bellows according to any one of claims 1 to 4, characterised in that the resilient material is peripherally interrupted in the region of the or each flexible wall portion (32A,32B,32C), and in that the peripherally spaced support means (34) extend from the outside surface of the or each flexible wall portion (32A,32B,32C) to terminate in a circumferential plane.
7. A bellows according to claim 6, characterised by further support means (36) extending in a circumferential direction for connecting and providing mutual support for each pair of adjacent ones of the peripherally spaced support means (34).
8. A bellows according to claim 7, characterised in that each further support means (36) is a respective rib made of flexible material.
9. A bellows according to any preceding claim, characterised in that each peripherally spaced support means (34) is a respective rib made of flexible material extending in a radial or chordal direction.
10. A bellows according to any preceding claim, characterised in that the or each flexible wall portion (32A,32B,32C) and the peripherally spaced support means (34) are arranged such that the fixing collar (28) exerts a gripping force on the outside peripheral surface of the housing (5) which is substantially constant around its periphery.
11. A bellows according to any preceding claim, characterised in that the thickness of the resilient material of the or each flexible wall portion (32A,32B,32C) and of each peripherally spaced support means (34) is between about 1mm and about 4mm.
12. A bellows according to any preceding claim, characterised in that it is moulded from thermoplastics material.
13. A protective bellows for attachment to an externally tri-lobed housing (5) of an articulation joint for the transmission of a motor vehicle, in which the bellows has an integral fixing collar (28) which is made of resilient material defining three mutually separated part-cylindrical surfaces (30A,30B,30C) lying in a common cylindrical plane and matching the external surfaces of the lobes (9,10,11) of the housing (5), the part-cylindrical surfaces (30A,30B,30C) being interconnected by three angularly spaced inwardly directed projecting surfaces (32A,32B,32C) shaped so as to match the external surface portions (6,7,8) on the housing (5) between the lobes

(9,10,11) thereof, characterised in that each projecting surface is formed by a wall portion (32A,32B,32C) integral with the part-cylindrical surfaces (30A,30B,30C), and a plurality of peripherally spaced supports (34) connected to and mounted on the outside of the projecting surfaces (32A,32B,32C) for resiliently supporting them, whereby the material of the fixing collar (28) sealingly grips the outside surface of the housing (5) with a substantially constant force around its periphery.

14. A bellows according to claim 13, characterised in that each support (34) is a respective integral rib (34) extending in a radial or chordal direction.
15. A bellows according to claim 13 or 14, characterised in that the resilient material of the integral fixing collar (28) is interrupted between the part-cylindrical surfaces (30A,30B,30C), and in that the peripherally spaced supports (34) have peripherally outward terminations lying in a circumferential plane which also includes the part-cylindrical surfaces (30A,30B,30C).
16. A bellows according to claim 15, characterised by further supports (36) each extending in a circumferential direction and each interconnecting and mutually supporting two of the peripherally spaced supports (34).
17. A bellows according to claim 13 or 14, characterised in that the resilient material of the integral fixing collar (28) is peripherally continuous and defines with the outside of each inwardly projecting surface (32A,32B,32C) a hollow volume, the peripherally spaced support means (34) being mounted within each hollow volume and extending therein between the outside of each inwardly projecting surface (32A,32B,32C) and the resilient material of the fixing collar (28).
18. A bellows according to any one of claims 13 to 17, characterised in that it is produced integrally by moulding from thermoplastics material.

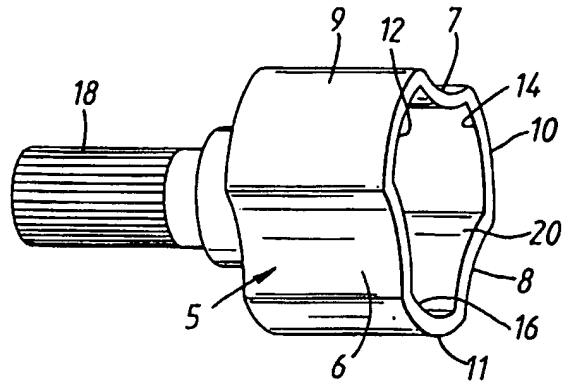


Fig.1

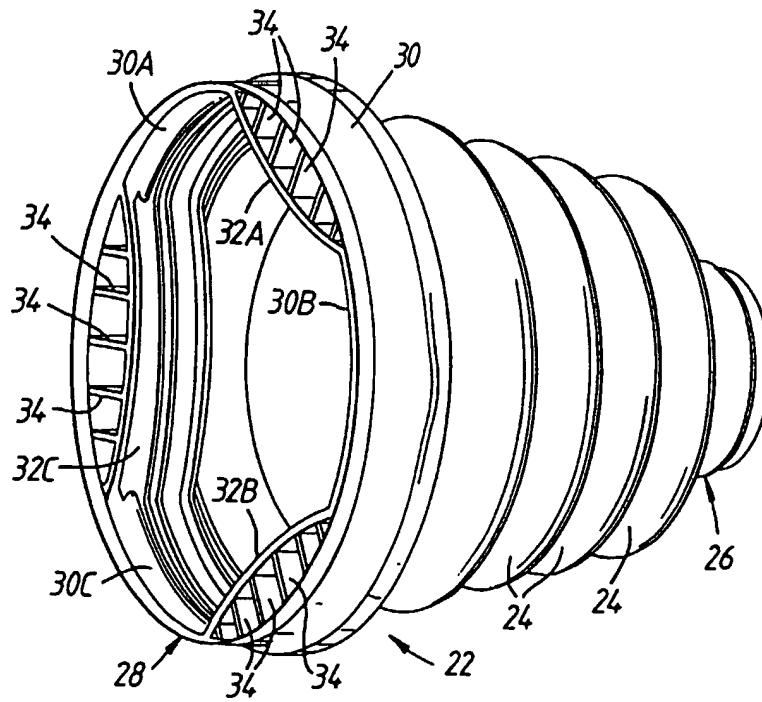


Fig.2

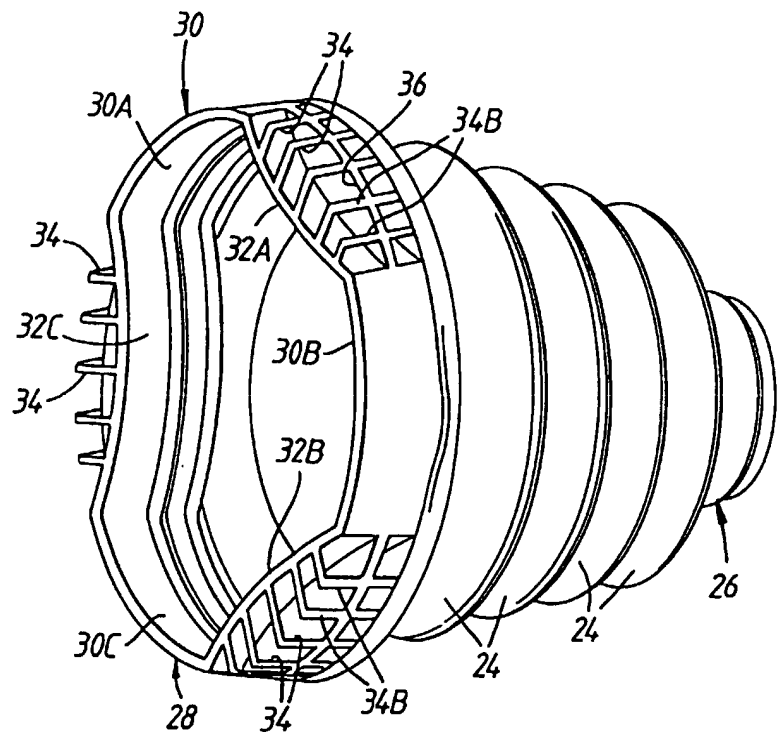


Fig.3